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Four new species of the sac spider genus *Planochelas* Lyle & Haddad, 2009 (Araneae, Trachelidae) from central and southern Africa

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Abstract

The genus *Planochelas* Lyle & Haddad, 2009 is endemic to the Afrotropical region. Members of the genus are very small, arboreal sac spiders. They are mainly collected by canopy fogging in tropical forest and savanna. In this study, four new species of *Planochelas* are described: *P. brevis* **sp. nov.**, *P. jocquei* **sp. nov.** (Democratic Republic of the Congo) and *P. haddadi* **sp. nov.**, *P. neethlingi* **sp. nov.** (South Africa). An updated key to the genus is provided, and the new species are illustrated by photographs and drawings. A distribution map for the genus is provided. This paper increases the number of species in the genus to seven.

Keywords

Afrotropical, arboreal sac spider, South Africa, canopy/tree fogging, endemic species, Trachelidae

Introduction

The family Trachelidae (Arachnida: Araneae) is currently represented in the Afrotropical region by 11 genera and 61 species (Table 1). It is one of the less studied families of spiders in the region and its diversity is poorly known (e.g. Haddad 2006; Haddad and Lyle 2008; Lyle and Haddad 2010). The family was first classified as a subfamily of Corinnidae by Simon (1897a) and lately elevated to family level by Ramírez (2014).

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Table 1. Current status of the mainland Afrotropical Trachelidae genera, excluding species described in present paper (World Spider Catalog 2019).

Genus	Author	Number of species
Afroceto	Lyle & Haddad, 2010	16
Fuchiba	Haddad & Lyle, 2008	6
Fuchibotulus	Haddad & Lyle, 2008	3
Jocquestus	Lyle & Haddad, 2018	7
Orthobula	Simon, 1897b	2
Patelloceto	Lyle & Haddad, 2010	3
Planochelas	Lyle & Haddad, 2009	3
Poachelas	Haddad & Lyle, 2008	4
Spinotrachelas	Haddad, 2006	5
Thysanina	Simon, 1910	6
Trachelas	L. Koch, 1872	6
Total		**61**

It is included in the Claw Tuft Clasper clade due to the unique block-like shape of the claw tuft setae present within the family and other related families.

Within the family, the presence and absence of leg spines and cusps vary greatly among the genera. For example, *Poachelas* Haddad & Lyle, 2008 and *Spinotrachelas* Haddad, 2006 have fully developed leg spines, while *Planochelas* Lyle & Haddad, 2009, *Fuchiba* Haddad & Lyle, 2008 and *Fuchibotulus* Haddad & Lyle, 2008, lacks spines and cusps (see also Lyle 2011). Instead, within the genus *Thysanina* Simon, 1910, the arrangements of cusps and spines vary greatly. The genus *Planochelas* lacks both spines and cusps, with the exception of *P. purpureus* Lyle & Haddad, 2009. This species has short leg spines. Members of the genus *Planochelas* are very small, arboreal and they have been collected by canopy fogging (Lyle and Haddad 2009).

Previous taxonomic studies have shown how in need of revision this family is (e.g. Haddad 2006; Haddad and Lyle 2008; Lyle and Haddad 2009, 2010). The material examined in this paper further supports the idea that members of the genus *Planochelas* are exclusively arboreal. All material examined was collected through tree fogging in various forests. These forests included Isangi forest, Monzé forest (Engengele), Mbangi forest, Yaekele forest, Itimbiri forest and Mikebo forest (Democratic Republic of the Congo), Ndumo Game Reserve and Isimangaliso Wetlands Park (South Africa). In the current paper, four new species of the genus *Planochelas* from central and southern Africa are described (Fig. 29), further increasing the known diversity of the Afrotropical trachelids.

Material and methods

Specimens were preserved in 70% ethanol and studied using a Nikon light microscope C-W 10XB/22. Photographs of the specimens were taken on the Zeiss Axio Zoom. V16 microscope and images were Z-stack using the ZEN Pro 12 software. Body meas-

urements were taken for all the specimens and expressed in millimetres (mm). Eyes and legs measurements were only taken for the largest male and female. The epigynes of selected female paratypes were dissected with a 0-size pin. A Branson 3200 ultrasonic was used to clear the dissected epigynes, after which they were boiled in hydrogen peroxide solution and ammonia. The cleaned epigynes were soaked overnight in acid fuchsin in lactophenol stain to improve pigmentation (Cilliers 1967). For the males, left palps of selected male paratypes were dissected and drawn. A light table was used to make drawings of epigynes and palps for each species. All dissected genitalia were retained in glass vials with the studied specimen.

The following abbreviations are used in the descriptions:

AL abdomen length
AER anterior eye row
ALE anterior lateral eye
AME anterior median eye
AMED anterior median eye diameter
AW abdomen width
CH clypeus height
CL carapace length
CW carapace width
FL fovea length
PER posterior eye row
PLE posterior lateral eye
PME posterior median eye
PMED posterior median eye diameter
RL retro lateral
RLV retro lateral ventral
SL sternum length
ST spermatheca
ST1 spermatheca 1
ST2 spermathecal 2
SW sternum width
TL total length.

Material used in this study was obtained from the following collections (curators or collection managers are sited in brackets):

NCA National Collection of Arachnida, ARC-Plant Health and Protection, Pretoria, South Africa (Petro Marais).
MRAC Musée royal de I' Afrique centrale, Tervuren, Belgium (Arnaud Henrard).
TMSA Ditsong National Museum of Natural History (former Transvaal Museum), Pretoria, South Africa (Martin Kruger).

Type material will be clearly indicated, in separated vails when returned to the collections they were loaned from.

Taxonomy

***Planochelas* Lyle & Haddad, 2009:92.**

Diagnosis. As described in Lyle and Haddad (2009), the genus can be recognised from other trachelid genera by a flattened carapace and abdomen, absence of spines and ventral cusps in both sexes (with the exception of *P. purpureus* Lyle & Haddad, 2009, with

short leg spines). Females have large ST2 with small transverse, posterolateral ST1. Males of the genus are recognised by the peculiar femoral apophysis, unique to the genus, which varies greatly in shape and size between species. The four newly described species in this paper are typical in appearance for the genus (Figs 1–8).

***Planochelas brevis* sp. nov.**
http://zoobank.org/21492268-AB67-4404-BF56-CDDCE315F37E
Figs 1–2, 9–13

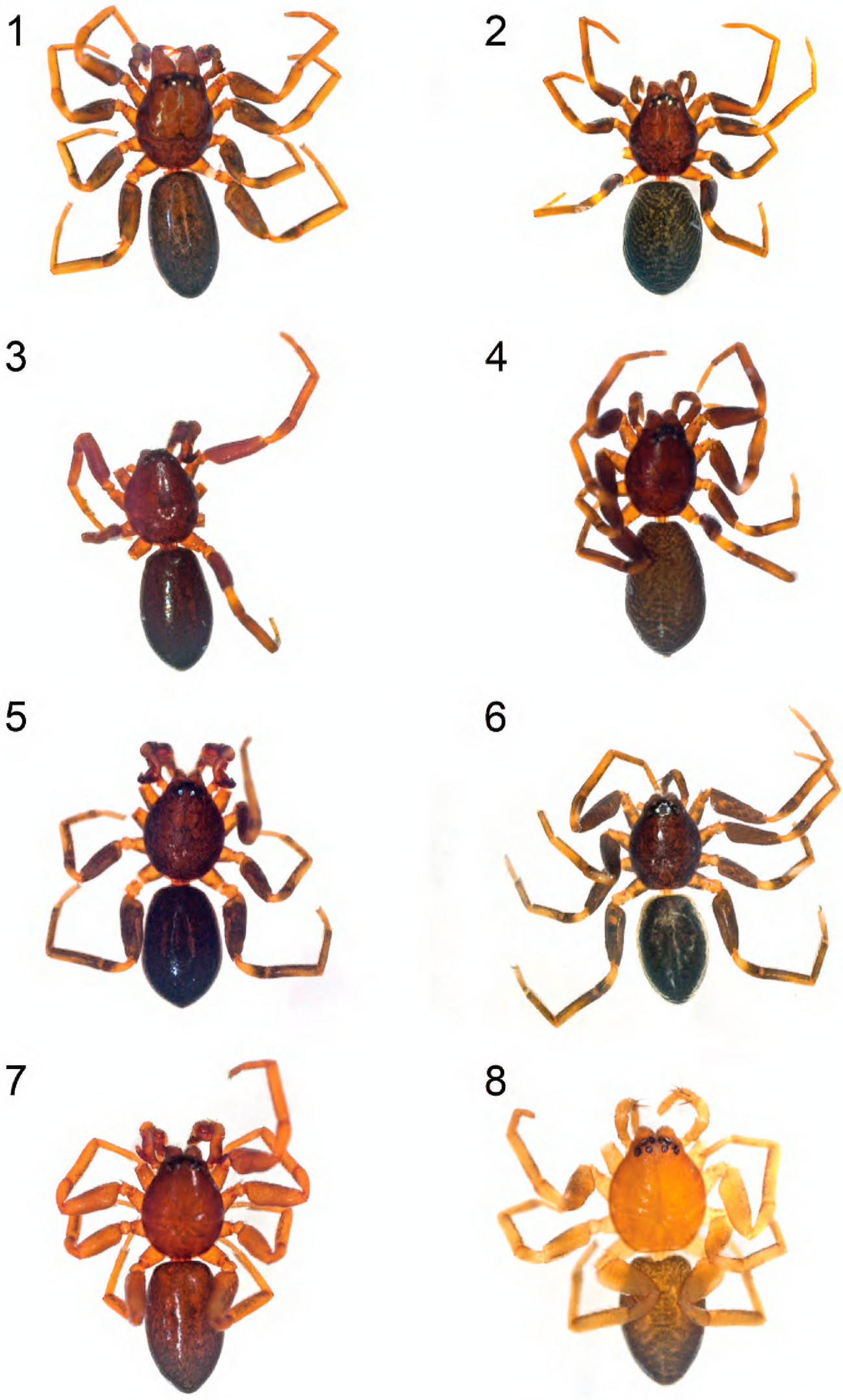
Etymology. The species name is derived from the Latin word 'brevis' meaning short, which refers to its short femoral apophysis found in the male of this species.

Diagnosis. This species has a similar habitus as other *Planochelas* species, but can be recognised by the short, blunt bilobed denticles in the femoral apophysis in males (compare *P. dentatus* Lyle & Haddad, 2009, that has bilobed, sharply point-denticles femoral apophysis) (Fig. 11). Females are recognised by the large, sausage-shaped ST2 (Figs 12–13) which is similar to *P. botulus* Lyle & Haddad, 2009 (figs 11–12, p 95). However, ST2 is shorter, more compact, with pronounced oblique arch in ST2. The ST1 in *P. brevis* sp. nov. is also slightly larger than in *P. botulus*.

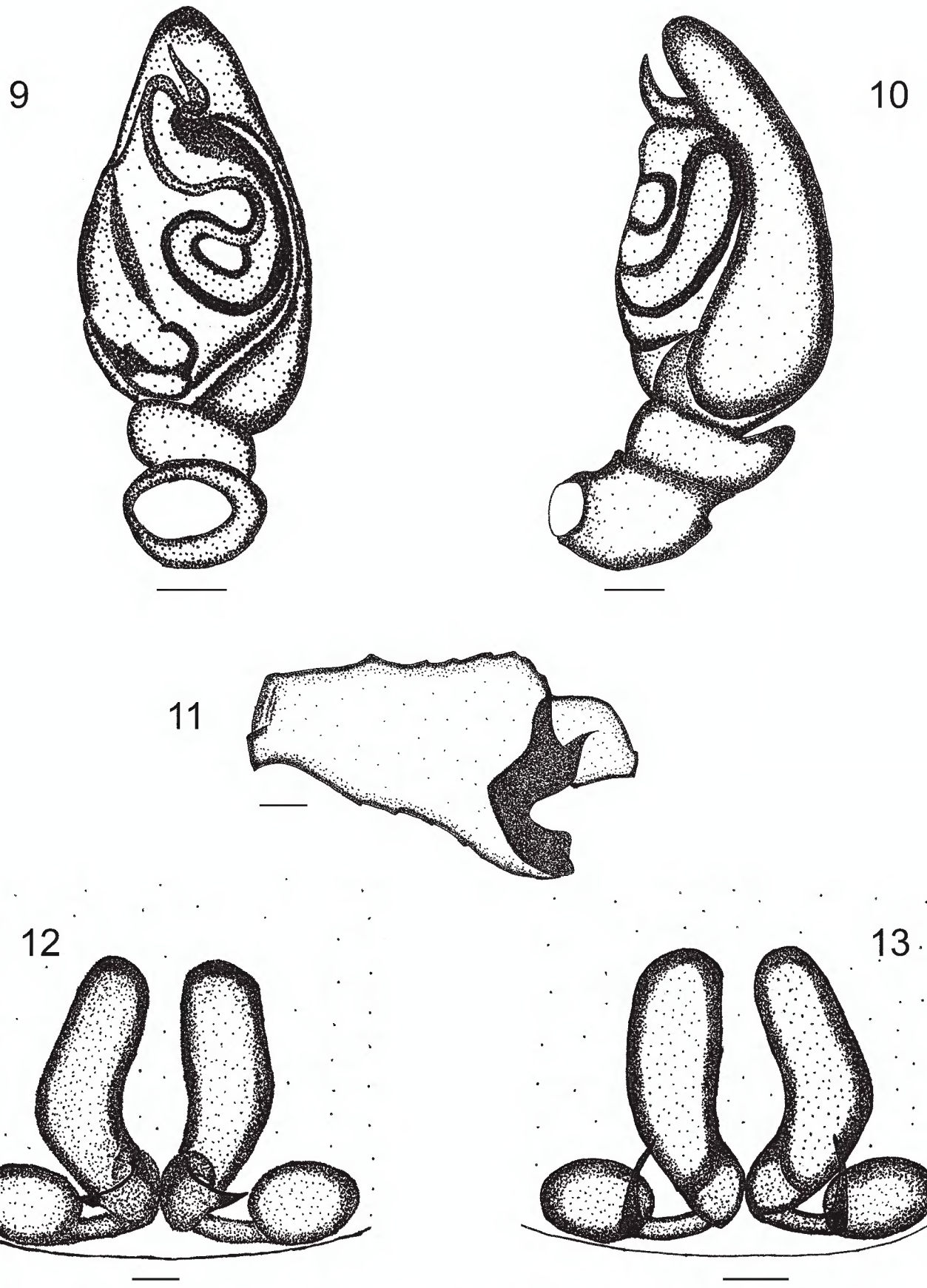
Description. Male. *Measurements*: CL – 0.94; CH – 0.05; CW – 0.86; AL – 1. 20; AW – 0.73; TL – 2.14; FL – 0.08; SL – 0.61; SW – 0.50. AME-AME – 0.05; AME-ALE – 0.02; AMED – 0.05; ALE-ALE – 0.19; PME-PME – 0.11; PME-PLE – 0.06; PMED – 0.05; PLE-PLE – 0.35. Length of leg segments (sequence from coxa, trochanter, femur, patella, tibia, metatarsus, tarsus and total): I 0.31 + 0.09 + 0.57 + 0.27 + 0.46 + 0.43 + 0.32 = 2.45; II 0.23 + 0.08 + 0.53 + 0.18+ 0.36 + 0.43 + 0.27 = 2.08; III 0.18 + 0.08 + 0.55 + 0.25 + 0.40 + 0.34 + 0.20 = 2; IV 0.23 + 0.08+ 0.68+ 0.26+ 0.55+ 0.52 + 0.26 = 2.58.

Carapace: dark-brown, first three-quarters rounded, last quarter with a steep decline; surface pitted; fovea very short, situated two-thirds of CL (Fig. 1). *Clypeus*: CH equals AME diameter. *Eyes*: ocular region brown, with black rings around eyes; AER slightly procurved; ALE larger than AME; AME separated by distance equals their diameter; AME separated from ALE by distance smaller than their diameter; PER almost straight; PME smaller than PLE; PME separated by distance larger than their diameter; PLE separated from PME by distance larger than PME diameter. *Chelicerae*: brown; anterior surface covered in short, with fine setae; one large promarginal tooth situated distally, two sub equal retromarginal teeth, one situated distally, and other medially situated. *Sternum*: brown; shield-like, darker towards border; with long setae. *Abdomen*: dark brown; oval-like. *Legs*: light to dark brown; femur dark; patella and tibia ventral side dark; all segments covered with short, fine setae; no spines or cusps. *Palp*: brown, sharply curved embolus situated dorsally on tegulum (Fig. 10); sperm duct with several sharp bends (Fig. 9); palpal femur with blunt denticles dorsally on femoral apophysis (Fig. 11); patellar and tibial apophysis absent (Fig. 10).

Female. *Measurements*: CL – 0.85; CH – 0.04; CW – 0.82; AL – 1.10; AW – 0.73; TL – 1.95; FL – 0.04; SL – 0.64; SW – 0.51. AME-AME – 0.07; AME-ALE – 0.01;



Figures 1–8. Digital automontage photograph of somatic morphology of *P. brevis* sp. nov. **1** male and **2** female; *P. haddadi* sp. nov. **3** male and **4** female; *P. jocquei* sp. nov. **5** male and **6** female; *P. neethlingi* sp. nov. **7** male and **8** female.



Figures 9–13. Genitalic morphology of *P. brevis* sp. nov.: **9–11** male and **12–13** female **9** Palp, ventral view **10** Palp, retrolateral view **11** Femoral apophysis **12** Epigyne, ventral view **13** Epigyne, dorsal view. Scale bar: 0.1mm.

AMED – 0.04; ALE-ALE – 0.15; PME-PME – 0.10; PME-PLE – 0.07; PME – 0.05; PLE-PLE – 0.33. Length of leg segments (sequence from coxa, trochanter, femur, patella, tibia, metatarsus, tarsus and total): I 0.32 + 0.14 + 0.39 + 0.36 + 0.37 + 0.41 + 0.31 = 2.3; II 0.24 + 0.10 + 0.38 + 0.26 + 0.45 + 0.42 + 0.31 = 2.16; III 0.23 + 0.15 + 0.53 + 0.32 + 0.33 + 0.36 + 0.25 = 2.17; IV 0.30 + 0.11 + 0.65 + 0.33 + 0.51 + 0.43 + 0.20 = 2.53.

Carapace: dark-brown, first three-quarters rounded, last quarter with a steep decline; surface pitted; fovea very short, situated two-thirds of CL (Fig. 2). *Clypeus*: CH equals AME diameter. *Eyes*: ocular region brown, with black rings around eyes; AER slightly procurved; ALE larger than AME; AME separated by distance larger than their diameter; AME separated from ALE by distance smaller than their diameter; PME smaller than PLE; PME separated by distance larger than their diameter; PLE separated from PME by distance larger than PME diameter. *Chelicerae*: brown; anterior surface covered in short, fine setae; one large promarginal tooth situated distally, two retromarginal teeth situated distally. *Sternum*: brown; shield-like, darker towards border; smooth and shiny. *Abdomen*: mottled grey; oval-like. *Legs*: light to dark brown; femur dark; patella and tibia ventral side dark; all segments covered with short, fine setae; no spines or cusps. *Genitalia*: weakly sclerotized, with large, sausage-shaped ST2 with marked curvature, medially (Fig. 12); ST1 connect to ST2 by narrow transverse duct; small, medially direct copulatory openings, situated posteriorly in epigyne (Fig. 13).

HOLOTYPE ♀ and ALLOTYPE ♂. *Democratic Republic of the Congo*: Isangi forest, 0°47'N, 24°16'E, RMCA 234.533, D. de Bakker & J. L. Juakaly, 2009, canopy fogging (fog 13, young secondary forest), import/18/93817.

PARATYPES. *Democratic Republic of the Congo*: *Democratic Republic of the Congo*: Isangi forest, 0°47'N, 24°16'E, RMCA 234.533, 3♀ 3♂, D. de Bakker & J. L. Juakaly, 2009, canopy fogging (fog 13, young secondary forest), import/18/93817; Mbangi, 2°7'N, 21°44'E, 3♂ 1♀, RMCA 234.532, same collectors and date, canopy fogging (fog 6, old secondary forest), import/18/93816; same locality, 1♀, RMCA 234.536, same collector and date, canopy fogging (fog 3, old secondary forest), import/18/93820; Monzé (Engengele), 2°2'N, 22°44'E, ♂ MCA 234.539, same collector and date, canopy fogging (fog 9, periodically inundated old secondary forest), import/18/93823; same locality, 3♀, RMCA 234.519, same collector and date, canopy fogging (fog 7, old secondary forest), import/18/93803; Kona (Itimbiri), 2°3'N, 22°45'E, 1♀, RMCA 234.538, same collector and date, canopy fogging (fog 4, *Parinarium excelsum* primary forest), import/18/93822; Yaekela, 2010, 1♂ 1♀, RMCA 234.537, J. L. Juakaly, canopy fogging (fog 3, *Pentaclethra macrophylla*: primary forest), import/18/93821.

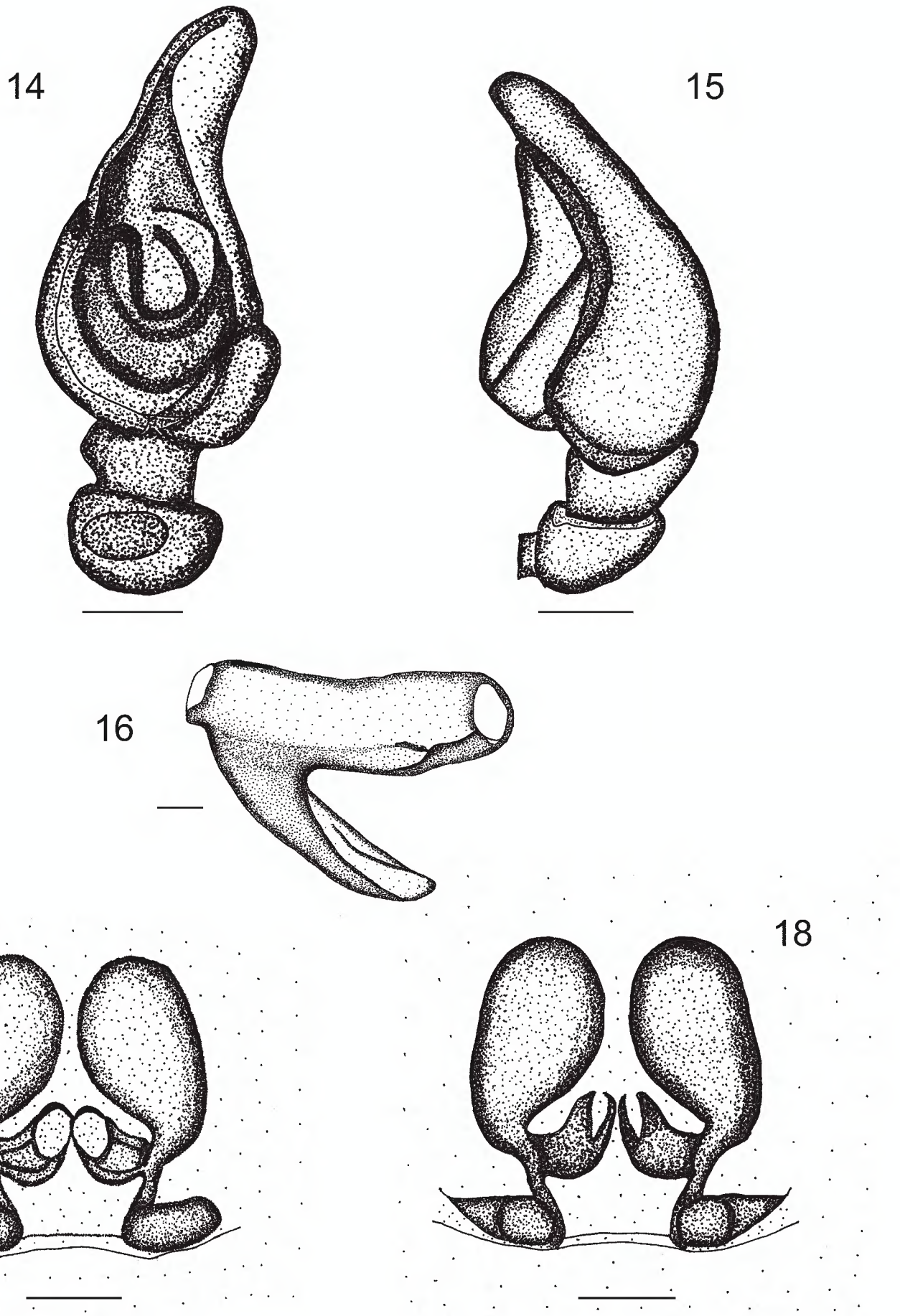
Distribution. Species is known from the Isangi forest, Kona (Itimbiri), Mbangi and Monzé (Engengele) (Fig. 29).

Biology. Due to the nature in which the specimens were collected, this species is considered arboreal.

***Planochelas haddadi* sp. nov.**
http://zoobank.org/040611DF-F618-4D1A-81E5-963BEC31B258
Figs 3–4, 14–18

Etymology. The species is named in honour of Dr Charles Richard Haddad, who collected the type specimen of this species.

Diagnosis. For this species, males can be recognised by the large ladle-like femoral apophysis that ends in a rounded apex. This apophysis extends almost the entire length



Figures 14–18. Genitalic morphology of *P. haddadi* sp. nov.: **14–16** male and **17–18** female; **14** Palp, ventral view **15** Palp, retrolateral view **16** Femoral apophysis **17** Epigyne, ventral view **18** Epigyne, dorsal view. Scale bar: 0.1mm.

of the femoral segment, dorsally directed (Fig. 16), unlike the femoral apophysis of *P. jocquei* sp. nov. that ends in a sharply curved point. Females are recognised by a large, kidney- shaped ST2 (Figs 17, 18) and the small elliptical ST1. The copulatory openings are medially directed compared to other species in the genus.

Description. Male. *Measurements*: CL – 1.56; CH – 0.42; CW – 2.87; AL – 4.65; AW – 2.39; TL – 6.21; FL – 0.55; SL – 2.38; SW – 1.57. AME-AME – 0.41; AME-ALE – 0.23; AMED – 0.64; ALE-ALE – 2.16; PME-PME – 1.09; PME-PLE – 0.94; PMED – 0.69; PLE-PLE – 4.13. Length of leg segments (sequence from coxa, trochanter, femur, patella, tibia, metatarsus, tarsus and total): I 2.19 + 0.34 + 2.36 + 1.13 + 1.83 + 1.45 + 0.98 = 10.28; II missing; III missing; IV 1.98 + 0.35 + 2.02 + 1.05 + 1.66 + 1.15 + 1.05 = 9.26.

Carapace: reddish-brown, flattened, last three-quarters rounded, last quarter with a steep decline; surface finely pitted; fovea short, indistinct, situated two-thirds of CL (Fig. 3). *Clypeus*: CH less than AME diameter. *Eyes*: ocular region light brown, with black rings around eyes; AER almost straight; ALE larger than AME; AME separated by distance smaller than their diameter; AME separated from ALE by distance smaller than their diameter; PER almost straight; PME smaller than PLE; PME separated by distance larger than their diameter; PLE separated from PME by distance larger PME diameter. *Chelicerae*: brown; anterior surface covered in long, fine setae; one promarginal tooth situated distally, two retromarginal teeth, one situated distally, and the other promarginal situated. *Sternum*: brown, darker towards border; shield-like; shiny, with fine short setae. *Abdomen*: dark brown; oval-like; slightly elongated. *Legs*: light to dark brown; femur dark; patella and tibia ventral side dark, all segments covered in long, fine setae; no spines or cusps. *Palp*: brown, elongated, curved embolus extending to tip of cymbium (Fig. 14); sperm duct extend across the bulb with sharp bents; elongated, ladle-like femoral apophysis, extend almost the entire length of femur segment; femoral apophysis with rounded point (Fig. 16); patellar and tibial apophysis absent (Fig. 15).

Female. *Measurements*: CL – 1.56; CH – 0.35; CW – 1.38; AL – 2.47; AW – 1.50; TL – 4.03; FL – 0.16; SL – 2.37; SW – 1.62. AME-AME – 0.36; AME-ALE – 0.13; AMED – 0.59; ALE-ALE – 1.90; PME-PME – 1.05; PME-PLE – 0.48; PMED – 0.86; PLE-PLE – 4.02. Length of leg segments (sequence from coxa, trochanter, femur, patella, tibia, metatarsus, tarsus and total): I 0.98 + 0.37 + 1.89 + 1.23 + 1.60 + 1.20 + 0.93 = 8.2; II 0.89 + 0.48 + 1.66 + 1.04 + 1.61 + 2.26 + 1.66 = 9.6; III 0.74 + 0.42 + 1.25 + 0.96 + 1.11 + 0.93 + 0.47 = 5.88; IV 0.97 + 0.31 + 1.58 + 1.01 + 1.25 + 1.49 + 0.82 = 7.43.

Carapace: reddish dark-brown, flattened, last three-quarters rounded, last quarter with a steep decline; surface finely pitted; fovea medium, indistinct, situated two-thirds of CL (Fig. 4). *Clypeus*: CH less than AME diameter. *Eyes*: ocular region light brown, with black rings around eyes; AER almost straight, ALE larger than AME; AME separated by distance smaller than their diameter; AME separated from ALE by distance smaller than their diameter; PER almost straight; PME smaller than PLE; PME separated by distance larger than their diameter; PLE separated from PME by a distance smaller than the PME diameter. *Chelicerae*: brown, anterior surface covered in long, fine setae; one promarginal tooth situated distally; two retromarginal teeth, one situated distally and the other promarginally. *Sternum*: brown; shield-like, darker towards border; shiny, with fine short setae. *Abdomen*: dark brown; oval-like, slightly elongated. *Legs*: light to dark brown; femur dark; patella and tibia ventral side dark; all segments covered with long, fine se-

tae; no spines or cusps. *Genitalia*: weakly sclerotized, with large, obovate shaped, ST2 (Fig. 17) link to small elliptical ST1 (Fig. 18); medially opening copulatory openings.

HOLOTYPE ♀, ALLOTYPE ♂ and PARATYPE ♀. *South Africa*: KwaZulu-Natal Province, Ndumo Game Reserve (Environmental Centre), TMSA 23986, 26°55.337'S, 32°18.145'E, 122m a.s.l., C. Haddad, V. Swart & A. Kirk-Spriggs, 28.xi. 2009, canopy fogging (fog 22, *Strynchos spinosa,* deciduous broadleaf woodland), 08:15 am, 8m, sheeting 54m^2.

Distribution. Species is only known from the type locality (Fig. 29).

Biology. Due to the nature in which the specimens were collected, this species is considered arboreal.

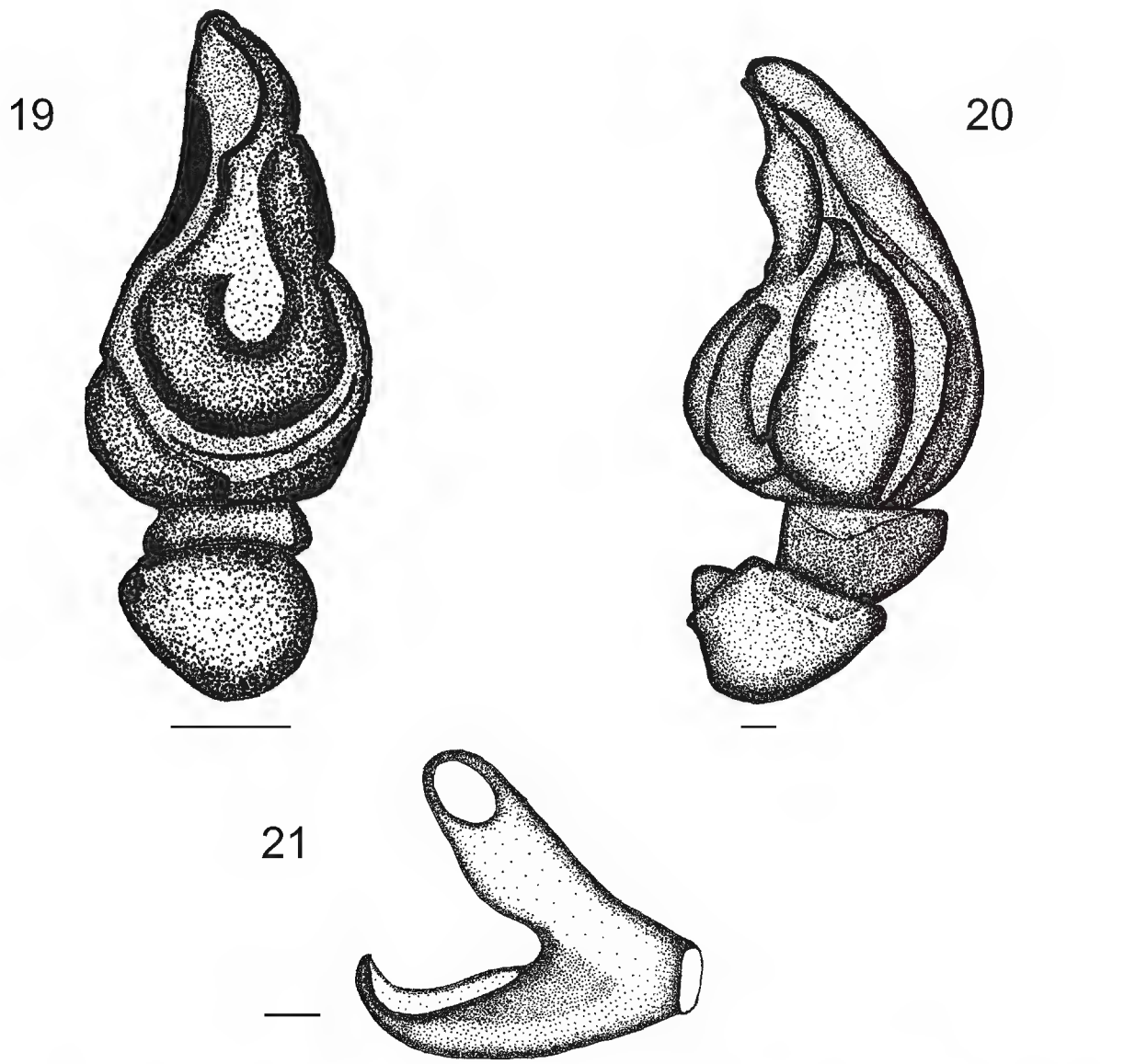
***Planochelas jocquei* sp. nov.**
http://zoobank.org/571B450F-7AD9-498C-B663-ABE5198D1D62
Figs 5–6, 19–23

Etymology. The species is named in honour of Dr Rudy Jocqué in recognition of his contribution to the field of Arachnology in the Afrotropical region throughout his career.

Diagnosis. The males of this species can be recognised by the large ladle-like femoral apophysis that ends in a sharply curved point (Fig. 21), unlike *P. haddadi* sp. nov. and *P. neethlingi* sp. nov. that end in rounded points. The femoral apophysis extends to the end of the entire length of the femoral segment. The female of this species can be recognised by the large, oval shaped ST2 (Figs 22, 23), similar to the *P. dentatus* Lyle & Haddad, 2009 (figs 17, 18, p 96). *P. jocquei* sp. nov. can be recoginised from *P. dentatus* by the narrow copulatory ducts that are almost half the width of *P. dentatus.*

Description. Male. *Measurements*: CL – 0.73; CH – 0.04; CW – 0.70; AL – 1.17; AW – 0.71; TL – 1.90; FL – 0.15; SL – 0.60; SW – 0.47. AME-AME – 0.02; AME-ALE – 0.01; AMED – 0.03; ALE-ALE – 0.13; PME-PME – 0.08; PME-PLE – 0.06; PMED – 0.05; PLE-PLE – 0.25. Length of leg segments (sequence from coxa, trochanter, femur, patella, tibia, metatarsus, tarsus and total): I 0.27 + 0.08 + 0.49 + 0.35 + 0.48 + 0.35 + 0.26 = 2.28; II 0.22 + 0.12 + 0.57 + 0.28 + 0.44 + 0.28 + 0.30 = 2.21; III 0.14 + 0.08 + 0.46 + 0.31 + 0.39 + 0.26 + 0.19 = 1.83; IV 0.24 + 0.10 + 0.46 + 0.29 + 0.52 + 0.37 +0.27 = 2.25.

Carapace: dark-brown, first three-quarters rounded, last quarter with a steep decline; surface pitted; fovea short, situated two-thirds of CL (Fig. 5). *Clypeus*: CH more than AME diameter. *Eyes*: ocular region brown, with black rings around eyes; AER straight; ALE larger than AME; AME separated by distance smaller than their diameter; AME separated from ALE by distance smaller than their diameter; PER almost straight; PME smaller than PLE; PME separated by distance larger than their diameter; PLE separated from PME by distance larger than PME diameter. *Chelicerae*: brown, anterior surface covered in long setae; one promarginal tooth situated distally, two retromarginal teeth, one situated distally and other promarginal situated. *Sternum*: brown; shield-like, darker towards border; shiny, with fine short setae. *Abdomen*: dark-brown, oval-like, slightly elongated with two pale parallel patches. *Legs*: light to dark-brown; femur dark;



Figures 19–23. Genitalic morphology of *P. jocquei* sp. nov.: **19–21** male and **22–23** female **19** Palp, ventral view **20** Palp, retrolateral view **21** Femoral apophysis **22** Epigyne, ventral view **23** Epigyne, dorsal view. Scale bar: 0.1mm.

patella and tibia ventral side dark; all segments covered with short, fine setae; no spines or cusps. *Palp:* brown, slightly curved, thick embolus situated distally on tegulum; large sperm duct extending transversely in bulb (Fig. 19); palpal femur with large ladle-like apophysis that extends into a sharply curved point; femoral apophysis extends almost the entire femur segment length (Fig. 21); patellar and tibial apophysis absent (Fig. 20).

Female. *Measurements*: CL – 0.94; CH – 0.04; CW – 0.78; AL – 1.28; AW – 0.93; TL – 2.29; FL – 0.18; SL – 0.66; SW – 0.51. Eyes: AME-AME – 0.04; AME-ALE – 0.02; AMED – 0.06; ALE-ALE – 0.14; PME-PME – 0.07; PME-PLE – 0.05; PMED – 0.07; PLE-PLE – 0.28. Length of leg segments (sequence from coxa, trochanter, femur, patella, tibia, metatarsus, tarsus and total): I 0.27 + 0.07 + 0.66 + 0.40 + 0.50 + 0.39 + 0.35 = 2.64; II 0.26 + 0.12 +0.53 + 0.32 + 0.42 + 0.34 + missing = 1.99; III 0.23 + 0.09 + 0.46 + 0.28 + 0.36 + 0.28 + 0.23 = 1.93; IV 0.28 + 0.13 + 0.57 + 0.31 + 0.59 + 0.37 + 0.30 = 2.55.

Carapace: dark-brown, first three-quarters rounded, last quarter with a steep decline; surface pitted; fovea short, situated two-thirds of CL (Fig. 6). *Clypeus*: CH less than AME diameter. *Eyes*: ocular region brown, with black rings around eyes; AER straight; ALE larger than AME; AME separated by distance smaller than their diameter; AME separated from ALE by distance smaller than their diameter; PER almost straight, PME smaller than PLE; PME separated by distance equals their diameter; PLE separated from PME by distance smaller than PME diameter. *Chelicerae*: brown, anterior surface covered in long setae; one promarginal tooth situated distally, two retromarginal teeth, one situated distally and other promarginal situated. *Sternum*: brown; shield-like, darker towards border; shiny, with fine short setae. *Abdomen*: mottled grey, oval-like, slightly elongated with two pale parallel patches. *Legs*: light to dark-brown; femur dark; patella and tibia ventral side dark; all segments covered with short, fine setae; no spines or cusps. *Genitalia*: weakly sclerotized, with large, oval shaped ST2, medially touching (Fig. 22); small, rounded ST1 connected to ST2 by short lateral ducts (Fig. 23); posteromedial directed copulatory opening.

HOLOTYPE ♀ and ALLOTYPE ♂. *Democratic Republic of the Congo*: Mikebo forest, 11°28'S, 027°39'E, MRAC 234.526, R. Jocqué, Canopy fogging (fog 3).

PARATYPES. *Democratic Republic of the Congo*: Mikebo forest, 11°28'S, 027°39'E, 3♂, MRAC 234.522, R. Jocqué, Canopy fogging (fog 1); same data, 2♂, MRAC 234.527, same collector, Canopy fogging (fog 2).

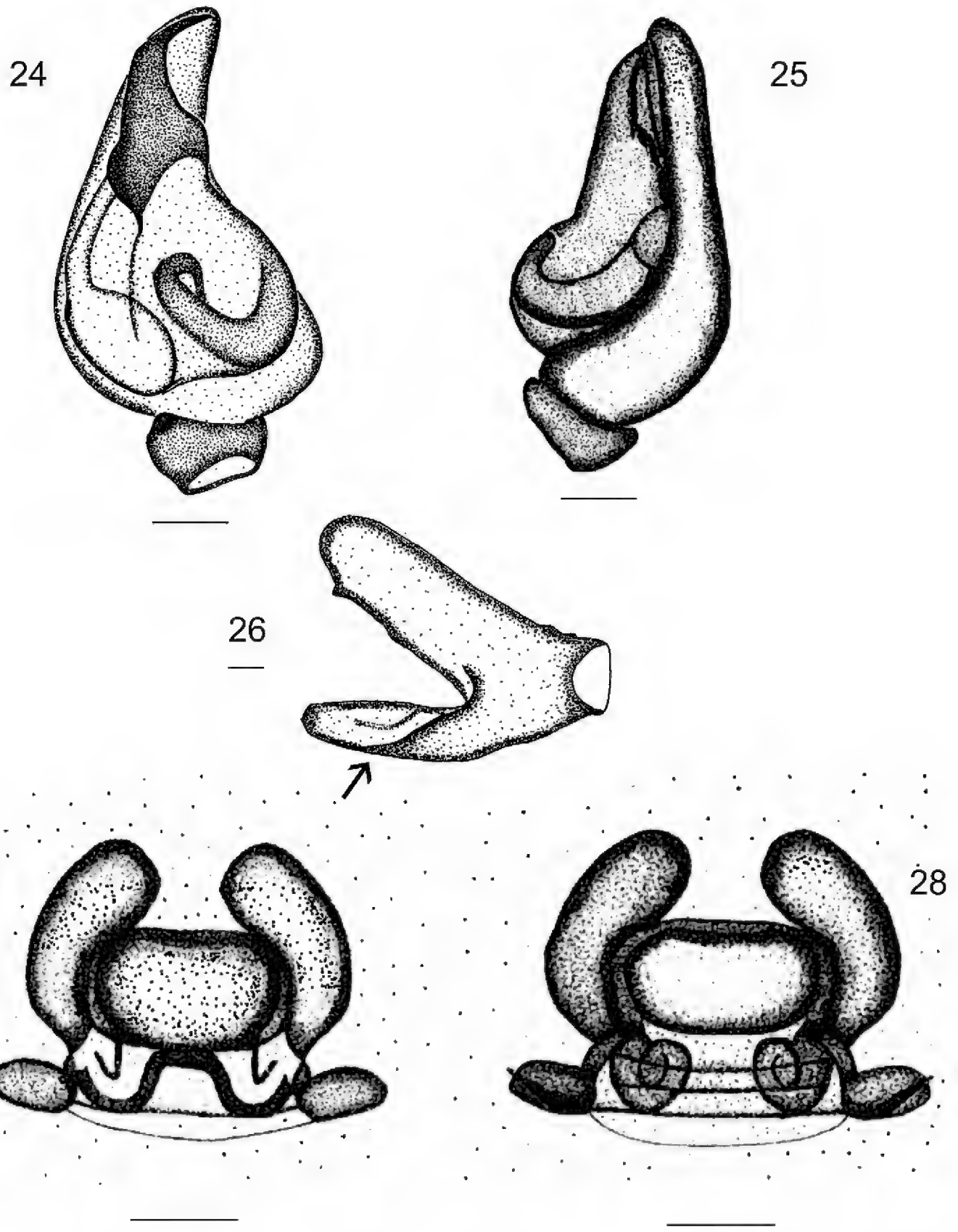
Distribution. Species is only known from the type locality (Fig. 29).

Biology. Due to the nature in which the specimens were collected, this species is considered arboreal.

***Planochelas neethlingi* sp. nov.**
http://zoobank.org/84DBA9B5-F3E0-46DD-B174-1C3C3E161BFE
Figs 7–8, 24–28

Etymology. The species is named after Mr Jan Andries Neethling who collected the type specimen.

Diagnosis. Males of this species can be recognised by the contorted femoral apophysis that extends the length of the femoral apophysis (Fig. 26). This apophysis is similar in length to that of *P. haddadi* sp. nov. and *P. neethlingi* sp. nov., but the fold (indicated by arrow in Fig. 26) is a unique character to this species. The female of *P. neethlingi* can be recognised by its large, bean-shaped ST2 (Fig. 27) that is significantly more widely separated than the other females described in this paper.



Figures 24–28. Genitalic morphology of *P. neethlingi* sp. nov.: **24–26** male and **27–28** female **24** Palp, ventral view **25** Palp, retrolateral view **26** Femoral apophysis **27** Epigyne, ventral view **28** Epigyne, dorsal view. Scale bar: 0.1mm.

Description. Male *Measurements*: body: CL – 3.46; CH – 0.35; CW – 3.19; AL – 4.88; AW – 2.98; TL – 8.34; FL – 0.27; SL – 4.68; SW – 3.48. Eyes: AME-AME – 0.17; AME-ALE – 0.07; AMED – 0.30; ALE-ALE – 0.65; PME-PME – 0.31; PME-PLE – 0.24; PMED – 0.23; PLE-PLE – 1.224. Length of leg segments (sequence from coxa, trochanter, femur, patella, tibia, metatarsus, tarsus and total): I 2.42 + 0.44 + 2.22 + 1.31 + 2.13 + 1.57 + 1.25 = 11.34; II 2.11 + 0.40 + 2.23 + 1.19 + 1.77 + 1.56

+ 1.00 = 10.23; III 1.69 + 0.41 + 1.83 + 0.73+ 1.36 + 1.38 + 0.82 = 8.22; IV 2.20 + 0.36 + 1.71 + 1.15 + 1.61 + 1.75 + 0.95 = 9.73.

Carapace: brown, flattened, last three-quarters rounded, last quarter slightly flattened; surface finely pitted; fovea medium, indistinct, situated two-thirds of CL (Fig. 7). *Clypeus*: CH more than AME diameter. *Eyes*: ocular region brown, with black rings around eyes; AER procurved, almost straight; ALE larger than AME; AME separated by distance smaller than their diameter; AME separated from ALE by distance smaller than their diameter; PER almost straight; PME smaller than PLE; PME separated by distance larger than their diameter; PLE separated from PME by distance larger than their PME diameter. *Chelicerae*: brown, anterior surface covered in long setae; one promarginal tooth situated distally, two retromarginal teeth, one situated distally and the other promarginal situated. *Sternum*: brown; shield-like, darker towards border; shiny, with fine long setae. Abdomen: dark brown, oval-like and slightly elongated. *Legs*: light brown; femur light to dark; patella and tibia ventral side light to dark; all segments covered with short, distinct setae; no spines or cusps. *Palp*: dark brown, embolus tapering into fine point, distally on tegulum (Fig. 24); palpal femur with large, contorted femoral apophysis, extending length of segment (Fig. 26); patellar and tibial apophysis absent (Fig. 25).

Female. *Measurements*: body: CL – 3.62; CH – 0.02; CW – 3.10; AL –4.11; AW – 2.60; TL – 7.74; FL – 0.57; SL – 5.26; SW –3.70. Eyes: AME-AME 0.33–; AME-ALE –0.06; AMED – 0.13; ALE-ALE – 0.63; PME-PME – 0.36; PME-PLE – 0.24; PMED – 0.18; PLE-PLE – 1.25. Length of leg segments (sequence from coxa, trochanter, femur, patella, tibia, metatarsus, tarsus and total): I missing; II 0.26 + 0.12 + 0.59 + 0.38 + 0.55 + 0.35 + 0.27 = 2.52; III 0.21 + 0.11 + 0.44 + 0.30 + 0.37 + 0.28 + 0.16 = 1.87; IV 0.28 + 0.10 + 0.47 + 0.36 + 0.57 + 0.34 + 0.21 = 2.33.

Carapace: brown, flattened, last three-quarters rounded, last quarter slightly flattened; surface finely pitted; fovea medium, indistinct, situated two-thirds of CL (Fig. 8). *Clypeus*: CH less than AME diameter. *Eyes*: ocular region brown, with black rings around eyes; AER procurved, almost straight; ALE larger than AME; AME separated by distance larger than their diameter; AME separated from ALE by distance smaller than their diameter; PER almost straight; PME smaller than PLE; PME separated by distance larger than their diameter; PLE separated from PME by distance larger than PME diameter. *Chelicerae*: brown, anterior surface covered in long setae; one promarginal tooth situated distally, two retromarginal teeth, one situated distally and other promarginal situated. *Sternum*: brown; shield-like; darker towards border; shiny, with fine long setae. *Abdomen*: mottled grey, oval-like and slightly elongated. *Legs*: light brown; femur light, patella and tibia ventral side light to dark; all segments covered in short, distinct setae; no spines or cusps. *Genitalia*: weakly sclerotized, with small elliptical ST1 connect by narrow dusts to large, sausage-shaped ST2 (Fig. 27); ST2 widely separated; round copulatory opening (Fig. 28).

HOLOTYPE ♀. *South Africa*: KwaZulu-Natal Province, iSimangaliso Wetland Park, 28°14'07.5"S, 32°29'21.0"E, 14m a.s.l., NCA 2018/344, J.A. Neethling and C. Luwes, 14.V.2012, canopy fogging 6 (fog 6), Wetland, *Syzygium cordatum*, Time: 11:00 pm, Height 6m, sheeting 54m^2.

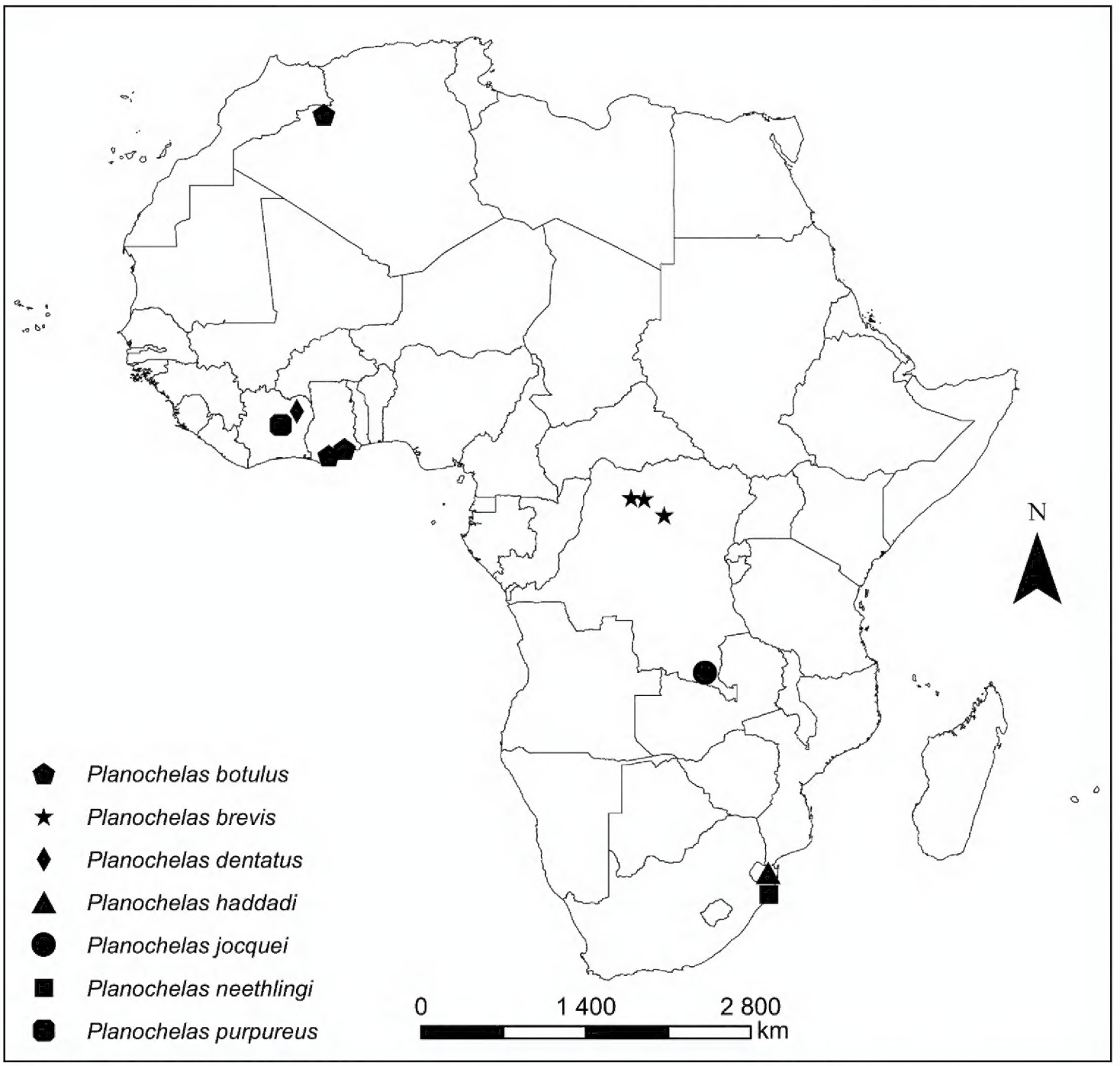


Figure 29. Distribution of the four new species *Planochelas brevis*, *P. haddadi*, *P. jocquei* and *P. neethlingi*.

ALLOTYPE ♂. *South Africa*: KwaZulu-Natal Province, iSimangaliso Wetland Park, St. Lucia, 28°23'02.3"S, 32°24'25.7"E, NCA 2018/343, J.A. Neethling & C. Luwes, 13. V.2012, canopy fogging (fog 4, coastal forest, *Trichilia dregeana* (forest mohogany)), 13:00 pm, 22m, sheeting 54m^2.

PARATYPES. *South Africa*: KwaZulu-Natal Province, iSimangaliso Wetland Park, 28°14'07.5"S, 32°29'21.0"E, 14m a.s.l, ♂, NCA 2018/344, J.A. Neethling & C. Luwes, 14.V.2012, canopy fogging (fog 6, *Syzygium cordatum*), 11:00am, 6m, sheeting 54m^2; iSimangaliso Wetland Park, 28°21'24.4"S, 32°25'11.0"E; 14.V.201, ♂, 2♀, NCA 2018/345, J.A. Neethling and C. Luwes, canopy fogging (fog 7, *Breonadia salicina* (Matumi)), 13:00 pm, 12m, Sheeting 54m^2.

Distribution. Known only from the type locality (Fig. 29).

Biology. Due to the nature in which the specimens were collected, this species is considered arboreal.

Updated key to species of the genus *Planochelas* Lyle & Haddad, 2009

1 Males **2**
– Females **8**
2 Anterior legs with short, fine paired ventral leg spines on tibiae and metatarsi fig. 22 in Lyle and Haddad 2009; palp with subrectangular dorsal femoral apophysis and small, rounded retrolateral patellar apophysis (figs 23, 24 in Lyle and Haddad 2009) ..... ***P. purpureus* Lyle & Haddad**
– Anterior leg spines absent; palp with dorsal femoral apophysis, patellar and tibial apophysis absent **3**
3 Palp with short femoral apophysis, not extending entire length of femur segment, usually ending in a bilobed point (e.g. Fig. 11) **7**
– Palp with large dorsal femoral apophysis, usually entire almost entire length of femur segment (e.g. Fig. 16) **4**
4 Femoral apophysis that ends in a sharp, narrowing point (fig. 16, p 95 in Lyle and Haddad 2009) ..... ***P. botulus* Lyle & Haddad**
– Femoral apophysis that appears ladle-like or with broadly rounded point..... **5**
5 Apophysis ending in a broad, rounded point; appears with a fold midway on apophysis length (Fig. 26); sharply pointed embolus (Fig. 24)..... ..... ***P. neethlingi* sp. nov.**
– Palp with large ladle-like femoral apophysis **6**
6 Apophysis with sharply curved tip, directed toward femur segment (Fig. 21); tapering embolus, ending at cymbium point (Fig. 19) ..... ***P. jocquei* sp. nov.**
– Apophysis ending in blunt rounded point (Fig. 16); embolus blunt ending embolus, ending at cymbium tip (Fig. 14) ..... ***P. haddadi* sp. nov.**
7 Apophysis comprising two sharply pointed denticles; embolus simple, slightly curved (fig. 20 in Lyle and Haddad 2009)..... ***P. dentatus***
– Palp with small, dorsal femoral apophysis comprising two blunted denticles (Fig. 9); embolus short, curved (Fig. 9) ..... ***P. brevis* sp. nov.**
8 ST 2 elongate, sausage-shaped..... **9**
– ST2 large, broad, oval or obovate **11**
9 ST2 closely situated medially with lateral or almost lateral connecting ducts (Fig. 12), close to epigastric fold, connecting to ST1 ..... **10**
– ST2 broadly situated from each other with oblique ducts to ST1 (Fig. 28), large copulatory openings (Fig. 27) ..... ***P. neethlingi* sp. nov.**
10 Elongated sausage-shaped ST2 connected to round ST1 with slightly curved, lateral ducts (Fig. 12); copulatory opening are posteromedial situated..... ..... ***P. brevis* sp. n.**
– Elongate, sausage-shaped ST 2 connected to small, rounded ST1 by lateral ducts, copulatory opening anteromedial (fig. 11, p 95 in Lyle and Haddad 2009)..... ***P. botulus***

11 ST2 is large, oval shaped **12**
– Obovate-shaped ST2 (Fig. 17) connect to elliptical ST1 by oblique ducts; copulatory openings medially directed ..... ***P. haddadi* sp. nov.**
12 ST2 connected by short ducts to rounded ST1 (Fig. 23); copulatory opening posteromedially directed (Fig. 22) ..... ***P. jocquei* sp. nov.**
– ST2 joined to bilobed ST1 by narrow oblique ducts (fig. 17, p 96 in Lyle and Haddad 2009); large copulatory openings anteriorly directed ..... ***P. dentatus***

Discussion

This study increases the number of species of the genus *Planochelas* to seven. All four new species described, *P. brevis* sp. n, *P. haddadi* sp. nov., *P. jocquei* sp. nov. and *P. neethlingi* sp. nov., are currently endemic to the country in which they have been collected. However, additional sampling is needed to determine the true distributions. There is a high likelihood that *P. jocquei* sp. nov. and *P. haddadi* sp. nov. will be found in the neighbouring countries, since they were collected very close to the South African border. The range extension of the genus to South Africa is significant. It shows that this genus is more widely spread than originally thought by Lyle and Haddad (2009).

Additionally, this paper highlights a typical historical sampling gap. Extensive sampling has been carried out in central Africa, through institutions such as the Royal Museum of Central Africa. In South Africa, concentrated efforts have been made to collect samples with the South African National Survey of Arachnida (SANSA) project (Dippenaar-Schoeman et al. 2010). Limited and sporadic sampling has been done in the countries north of South Africa, especially when compared to the effort put in during the SANSA project Phase II. The inclusion of canopy/tree fogging as an additional sampling method has been hugely beneficial to sample taxa, such as *Planochelas*, that have not been collected using standard methods.

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